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Title: VERTICAL CONVEYOR

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FIELD OF THE INVENTION

[0001] The present invention relates generally to the field of packing systems, with common but by no means exclusive application to conveyors used in the food industry.

BACKGROUND OF THE INVENTION

[0002] For the food industry, as for other industries, plant floor space is at a premium.

[0003] Certain types of forming and processing machines discharge their product at well above head-height (often 3 metres or more) above the floor level of the plant. The product typically must be lowered from this height to about waist-height (approximately 1 metre) above floor level for packing into boxes or other shipping containers.

[0004] Accordingly, the inventors have recognized a need for an effective conveyor system.

SUMMARY OF THE INVENTION

[0005] This invention is directed toward a conveyor system.

[0006] Specifically, the subject invention is directed towards a conveyor system comprising an inlet, an outlet, a first endless conveying element having a contact surface and configured to transport at least one object along a transportation path from proximate the inlet to proximate the outlet and securing means for securing the at least one object to the contact surface along a secured portion of the transportation path.

[0007] The invention is further directed towards a conveyor system comprising an inlet, an outlet, a first endless conveying element having a first contact surface and configured to transport at least one object along a transportation path from proximate the inlet to proximate the outlet, and a second endless conveying element having a securing surface positioned adjacent the contact surface along a secured portion of the transportation

path so that the at least one object is secured between the first and second conveying elements, along the secured portion of the transportation path.

[0008] Preferably, the conveyor system includes at least one main guide element for directing the first and second endless conveying elements along said secured portion of the transportation path. The main guide element typically includes a plurality of main guide rollers.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The present invention will now be described, by way of example only, with reference to the following drawings, in which like reference numerals refer to like parts and in which:

[0010] FIGURE 1 is a side view of a conveyor system made in accordance with the present invention.

[0011] FIGURE 2 is a side view of the conveyor system of Figure 1 with the housing removed.

[0012] FIGURE 3 is a side view of the conveyor system of Figure 1 with the housing and drive mechanism removed.

[0013] FIGURE 4 is a top schematic view of the conveyor system of Figure 1.

[0014] FIGURE 5 is an end cross-sectional view of a portion of an endless conveying element of an alternate configuration.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] Referring simultaneously to Figures 1, 2, 3 & 4, illustrated therein is a preferred embodiment of the conveyor system of the subject invention. The conveyor system, shown generally as 10, comprises a housing 12, a structural framework 13, an inlet 14 for receiving objects 16 such as frozen hamburger patties, and an outlet 18 for discharging the objects 16 from the system 10.

[0016] As can be seen in Figure 4, typically the inlet 14 and the outlet 18 are in substantial alignment with each other. The inlet 14 and the outlet 18

are substantially aligned with a vertical plane extending through line 21 and at 90° to the substrate on which Figure 4 is displayed. However, as shown in Figures 1 - 3, the inlet 14 and the outlet 18 are positioned proximate different vertical heights, a first height 22 and a second height 24 above the plant floor 25.

[0017] The conveyor system 10 also includes a first endless conveying element 20. Typically, the conveying element 20 is in the form of a belt, although other material such as webbing or a series of cables may also be used. The system 10 also includes securing means, shown generally as 29, for securing the objects 16 to the first endless conveying element 20. The securing means will typically take the form of a second endless conveying element 30, often in the form of a belt, although other material such as webbing or a series of cables may also be used.

[0018] The conveyor system 10 also includes a plurality of guide rollers to guide the conveying elements 20, 30 over their respective circuits. First conveying element 20 travels in sequence over guide roller 50, then in serpentine manner clockwise over first main guide element in the form of a first main guide roller 52 and counterclockwise over a second main guide element in the form of a second main guide roller 54, before passing over guide rollers 56, 58 and 60 and back to guide roller 50. Guide roller 56 is provided with a biasing mechanism such that the guide roller 56 functions as a conveyor tensioner in known manner to maintain the tension of the conveying element 20.

[0019] The second conveying element 30 travels in sequence over pinch roller 70, and then in serpentine manner clockwise over main guide roller 52 and counterclockwise over main guide roller 54, before passing over guide rollers 72, 74, 76 and back to pinch roller 70. Guide roller 76 is provided with a biasing mechanism such that the tension guide roller 76 functions in known manner as a conveyor tensioner to maintain the tension of the conveying element 30.

[0020] The first conveying element 20 has a contact surface 26 on which the objects 16 are transported along the transportation path A-B which commences at about position A (which extends laterally across substantially the width of the first conveying element 20) proximate the inlet 14 and follows the direction of travel of the first endless conveying element 20 and ends about position B (which extends laterally across substantially the width of the first conveying element 20) proximate the outlet 18. As will be understood, proximate the inlet 14, the contact surface 26 is typically the upper surface of the first conveying element 20.

[0021] The second conveying element 30 has a securing surface 32 which secures the objects 16 to the contact surface 26 while the objects 16 are transported along a substantially curvilinear secured portion C-D of the transportation path A-B commencing from about position C (which extends laterally across substantially the width of the first conveying element 20) proximate the pinch roller 70 and following the direction of travel of the first endless conveying element 20 to about position D (which extends laterally across substantially the width of the first conveying element 20) proximate the bottom of the second main guide roller 54.

[0022] As will also be understood, commencing about position C, the second conveying element 30 (and accordingly the securing surface 32) is guided into close and typically overlapping proximity with the first conveying element 20 (and correspondingly the contact surface 26) by pinch roller 70 such that objects 16 are positioned or sandwiched between the securing surface 32 and the contact surface 26. The proximity between the securing surface 32 and the contact surface 26 is maintained over the secured portion C-D of the transportation path A-B.

[0023] As should also be apparent, the tension of the conveying elements 20, 30 and their proximity to each other over the secured portion C-D of the transportation path A-B should be configured to secure and maintain the position of the objects 16 on the first conveying element 20.

[0024] The system 10 is also provided with a drive mechanism, shown generally as 80, for driving the first and second conveying elements 20, 30 at approximately the same speed. In the example illustrated, the drive mechanism 80 includes a variable speed electric motor unit 82 configured for driving a sprocket gear 84. The electric motor unit 82 is mounted to the structural framework 13. The second main guide roller 54 is fixed to an axle 86, to which is also fixed a sprocket gear 88, typically by welding the gear 88 to the axle 86. A first drive chain 90 connects the sprocket gears 84, 88, and transfers rotational power from sprocket gear 84 to drive the main guide roller 54.

[0025] A spur gear 92 is also fixed to the axle 86 of the main guide roller 54. A cooperative spur gear 94 is mounted to an idler shaft axle 96, and the axle 96 and spur gear 94 are positioned such that the spur gear 92 engages the spur gear 94. As a result, the spur gear 92 is able to drive the spur gear 94. A sprocket gear 98 is also fixed to the idler shaft axle 96. A third sprocket gear 100 is fixed to the axle 102 of the first main guide roller 52. A second drive chain 104 connects the sprocket gears 98, 100, and transfers rotational power from sprocket gear 98 to drive the first main guide roller 52.

[0026] As will be understood, each of the axles 86, 96, 102 is rotatably mounted to the structural framework 13.

[0027] For ease of configuration, preferably sprocket gears 84, 88, 98 and 100 are of substantially identical configuration (including having the same number of teeth). Spur gears 92 and 94 are also preferably of identical configuration (including having the same number of teeth). The main guide rollers 52, 54 are also preferably of approximately the same size. With the configuration of the various components as described above, the drive mechanism 80 is able to drive the main guide rollers 52, 54 at approximately the same speed and in opposite directions. Correspondingly, the first and second conveying elements 20, 30 are also driven at approximately the same speed.

[0028] Preferably, the conveying elements 20, 30 are selected to be somewhat elastic, to accommodate the shape of the objects 16 which are being transported over the secured portion C-D of the transportation path A-B. In situations in which the conveyor system 10 is to be used to convey food products, as will be understood the conveying elements 20, 30 should be selected to be safe for use with food and also sterilizable.

[0029] As should also be apparent, at around points E and F of the secured portion of the transportation path A - B, such portion is substantially vertical. As a result, the tension of the conveying elements 20, 30 and the securing force of the securing surface 32 relative to the contact surface 26 should be sufficient to hold the objects 16 in position on the contact surface 26 particularly at such vertical portions E, F.

[0030] As will also be understood, the size of the main guide rollers 52, 54 should be selected to be sufficiently large relative to the size of the objects 16 (and particularly in the case of objects 16 with limited structural strength, such that the bending force applied to the objects 16 as they are transported around the circumference of the main guide rollers 52, 54 is low enough to avoid breaking or otherwise damaging the objects 16. In the design depicted in Figures 1 and 2, the diameter of the main guide rollers 52, 54 is substantially one half of the difference between the height 22 proximate the inlet 14 and the height 24 proximate the outlet 18.

[0031] However, different sizes and configurations of the main guide rollers 52, 54 may be used. For example, while the conveyor system 10 has been illustrated and described as having two main guide rollers 52, 54, it should be understood that only one, or three or more main guide rollers may be used. If a plurality of guide rollers are used with the conveying elements 20, 30 travelling in serpentine fashion around them, it will typically be expected that the direction of travel of objects 16 entering the inlet 14 and the direction of travel of objects 16 leaving the outlet 18 will be substantially the same (but with the inlet 14 and outlet 18 on opposite sides of the conveyor system 10) if an even number of main guide rollers is used (ie. from left to

right in Figure 4), and substantially opposite if an odd number of main guide rollers is used (but with the inlet 14 and outlet 18 on the same side of the conveyor system 10). Similarly, if only a single main guide roller is used, it will typically be expected that the direction of travel of objects 16 entering the inlet 14 and the direction of travel of objects 16 leaving the outlet 18 will be substantially opposite (but with the inlet 14 and outlet 18 on the same side of the conveyor system 10).

[0032] Referring more specifically to Figure 4 (which has been schematically adjusted to show the outlet 18 which would not otherwise be visible from a top view of the configuration shown in Figures 1 – 3), feeding 120 and receiving 122 endless conveyors may also be provided for loading and unloading objects 16 to and from the system 10, respectively. Objects 16 which enter the inlet 14 in a registered (or organized) manner, also exit the outlet 18 in a registered manner, which facilitates the packing of the objects 16 after exiting the conveyor system 10.

[0033] As well, while the embodiment of the present invention has been illustrated and described herein as utilizing large main guide rollers 52, 54, alternatively, it should be understood that the main guide elements might include a series of opposing and flexibly biased pinching rollers to define and guide the conveying elements 20, 30 along a transportation path, while at the same time providing sufficient securing force to secure the objects 16 to the contact surface 26 of the first conveying element 20.

[0034] Alternatively, provided that bearings, rollers or other means are used to minimize friction, a fixed curvilinear surface could be substituted in place of one or each main guide roller 52, 54, for guiding and maintaining sufficient tension and securing force of the conveyor elements 20, 30. With such a configuration, as will be understood, the drive mechanism 80 would require alteration to enable it to drive the conveyor elements 20, 30 at approximately the same speed.

[0035] Referring now to Figure 5, illustrated therein is an end cross-sectional view of an alternate configuration of a first endless conveying

element shown generally as 20'. The endless conveying element 20' includes a contact surface 26' on which objects 16 may be positioned. The conveying element 20' also includes a securing means 29' which includes a securing portion 31 of the endless conveying element 20'. The portion 31 includes a securing surface 32'. The portion 31 (and corresponds to the securing surface 32') may be moved or folded over into overlapping proximity to contact surface 26' such that objects 16 are positioned or sandwiched between the securing surface 32' and the contact surface 26'. Such an alternate embodiment avoids the need for the use of a second endless conveying element 30 illustrated in Figures 2 and 3, but the remaining elements of the system 10 remain substantially unchanged.

[0036] Thus, while what is shown and described herein constitute preferred embodiments of the subject invention, it should be understood that various changes can be made without departing from the subject invention, the scope of which is defined in the appended claims.